Temperature

ZOLL M Series

9650-0220-01 Rev. B

The issue date or revision level for this operation guide is shown on the front cover.
ZOLL and M Series are trademarks of ZOLL Medical Corporation.

© 2002 by ZOLL Medical Corporation. All rights reserved.

Table of Contents

PREFACE v
- How Do I Use This Manual? v
- Safety Summary v
- Indications for Use vi
- Contraindications for Use vi

INTRODUCTION 1
- What Can I Do With the Temperature Option? 1
- How Do I Use the Temperature Option? 1
- How Does the Temperature Option Work? 1

PREPARING TO TAKE MEASUREMENTS 2
- Selecting a Temperature Probe 2
- Turning on the Monitor 2
- Connecting the Temperature Probe 2

READING THE DISPLAY 3

SETTING ALARMS 4
- Setting Alarm Limits 4
- Enabling, Disabling and Suspending Alarms 4

PRINTING TEMPERATURE DATA 5

MAINTAINING THE TEMPERATURE OPTION 5
- Performing the Daily Checkout Procedure 5

SPECIFICATIONS 6

SOFTWARE LICENSE 7

ORDERING ACCESSORIES 8

TROUBLESHOOTING 9

INDEX 11

(This page intentionally left blank.)

Preface

How Do I Use This Manual?

This manual insert describes the set up and use of the M Series Temperature option. If you already know how to use the M Series, start by reading the Safety Summary, Indications for Use and Introduction sections of this insert. Familiarize yourself with all the procedures in this insert before you use the Temperature option. Consult the Troubleshooting section if the M Series fails to operate as expected.

If you do not know how to use the M Series, see the *M Series Operator's Guide* and the relevant inserts. Thoroughly read the safety considerations and warnings sections in both the M Series Operator's Guide and the relevant inserts before operating your M Series product.

Place this insert in the three-ring binder along with the *M Series Operator's Guide* and all other option inserts.

Safety Summary

The following is a short summary of warnings, cautions and other safety information related to the Temperature option. Additional warnings and cautions are in the text of this insert. Read this section thoroughly before operating the Temperature option.

- Read the *M Series Operator's Guide* and this manual insert before use.
- The M Series Temperature option is to be operated by qualified personnel only.
- Consult a physician for the proper interpretation of temperature measurements.
- Do not use in the presence of oxygen-rich atmospheres, flammable anesthetics or other flammable agents (such as gasoline). Do not use near the site of a gasoline spill. Explosion may result.
- The use of accessories, transducers and cables other than those specified in this manual, with the exception of transducers and cables sold by ZOLL as replacement parts for internal components, may result in increased emissions or decreased immunity of the M Series.
- Route patient cabling carefully to avoid patient entanglement or strangulation.
- Do not touch the bed, patient, or any equipment connected to the patient during defibrillation. A severe shock to the operator can result.
- Do not allow exposed portions of the patient's body to come in contact with metal objects, such as a bed frame during defibrillation. Unwanted electrical pathways can result.
- Avoid electrosurgery burns at monitoring sites by ensuring proper connection of the electrosurgery return circuit to ground. If improperly connected, some electrosurgery units allow other return paths to earth ground, even through fully isolated patient circuits in equipment operating from ac mains. If necessary, operate the monitor on battery power only to prevent a return to earth ground through the monitor.
- If an alarm occurs while the alarms are suspended, audio alarms do not sound, only visual alarms display.
- If the accuracy of measurements is suspect, first check the patient's vital signs by alternate means. Then check the cabling and M Series Temperature option for proper functioning.
- Do not immerse the M Series device, batteries, or cables in water, solvents, or cleaning solutions.
- Do not sterilize equipment except reusable sensors which may be sterilized per the manufacturer's instructions.

Safety Summary (cont.)

- Connect the ECG-out jack and modem (if available) only to other equipment with galvanically isolated circuits.
- The cable and temperature probe are defibrillator proof when used as directed with the M Series. Using the Temperature option introduces no risk for shock due to defibrillation. Using the Temperature option introduces no risk for burns due to electro-surgery.
- Do not reuse disposable sensors.
- Replace sensors that are worn or damaged.

Indications for Use

The ZOLL M Series Temperature option is indicated for measuring temperature of adult and pediatric patients using YSI 400 compatible temperature sensors.

Contraindications for Use

The ZOLL M Series Temperature option is not indicated for use on neonatal patients.

Introduction

What Can I Do With the Temperature Option?

Using the Temperature option you can do the following:

- Take two continuous temperature measurements simultaneously.
- Display two temperature values (T1 and T2) and the absolute value of the difference between the two values (ΔT).
- Print all three temperature values and their time of measurement.
- Store temperature measurements in code summary, trend memory, and a PCMCIA memory card.
- Configure alarms to go off when the unit detects temperature values above or below user-programmable limits.

How Do I Use the Temperature Option?

To take safe and accurate temperature measurements using the M Series Temperature option, you must do all of the following:

1. Select the proper YSI 400 compatible temperature probe.
2. Connect temperature probe to the patient and the M Series.
3. Configure alarms (if present settings are not appropriate).
4. Read the display.

Each step corresponds to a section in this chapter. Read each section carefully before you use the M Series Temperature option.

WARNING! Do not use the Temperature option without proper training.

How Does the Temperature Option Work?

The Temperature option consists of the following:

- YSI 400 compatible temperature probe.
- Temperature probe interface cable, if needed for use with disposable temperature probes.
- Data acquisition and signal processing module inside M Series unit.

When measuring temperature with the M Series, the following occurs:

1. Thermistor in temperature probe converts temperature to electrical resistance.
2. M Series unit measures this resistance, converts it into degrees Celsius or Fahrenheit and continuously displays the temperature values.
3. If two temperature probes are connected, the M Series unit also calculates and displays the difference between the two measured temperatures (ΔT).

Preparing to Take Measurements

The Temperature option has two temperature channels (T1 and T2). You must select and connect an appropriate temperature probe for each channel used.

Selecting a Temperature Probe

Use only disposable or reusable YSI 400 compatible temperature probes. See "Ordering Accessories" on page 8 for a list of ZOLL-approved temperature probes.

CAUTION! Do not use YSI 700 series temperature probes. Doing so may result in an inaccurate temperature measurement.

WARNING! The use of accessories, transducers and cables other than those specified by ZOLL may result in increased emissions or decreased immunity of the M Series.

Turning on the Monitor

To turn on the monitor:

- Turn the selector switch to **MONITOR** (**ON** for AED units).

Connecting the Temperature Probe

Using two temperature probes requires a 2-channel Y-adapter. See "Ordering Accessories" on page 8.

To connect the temperature probe:

1. Inspect the temperature probe and cable for wear, breakage or fraying. Replace if necessary.
2. Follow manufacturer's directions for use and your hospital's protocols on how to apply the temperature probe to the patient.
3. If you are using a disposable temperature probe, connect the temperature probe to the temperature cable.
4. If you are using two temperature probes, connect Y-adapter to temperature connector on the front panel of the M Series unit (see Figure 1: on page 3).
5. Connect the temperature probe cable(s) to the temperature connector or Y-adapter.
6. Verify that neither the CHECK TEMP PROBE nor the REPLACE TEMP PROBE messages display.

If desired, repeat steps 1 - 6 to connect a second temperature probe.

Reading the Display

If the temperature probe and cable are properly attached, the temperature values display immediately (see Fig. 1 and Fig. 2). When reading the temperature values on the display, keep in mind that the location of the probe on the patient can influence temperature measurements.

The *Temperature data display area* cycles between Temperature Channel 1 (T1), Temperature Channel 2 (T2), and the difference between the two values (ΔT). The data display area contains the following information:

- Temperature
- Alarm status
- Unit of measurement

NOTE Depending on the options included in your M Series, your front panel and display may slightly differ from the illustrations in this insert.

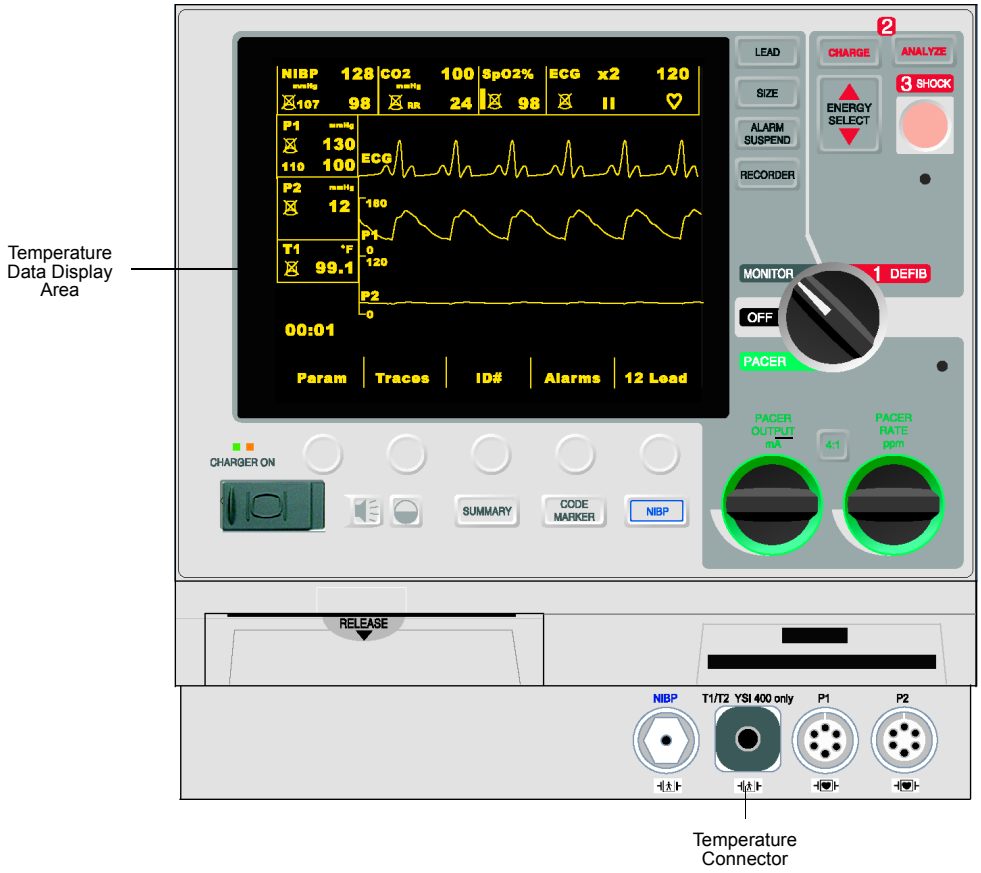

Figure 1: M Series Front Panel with Temperature Option

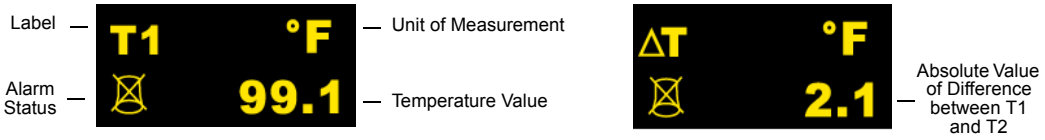

Figure 2: Temperature Data Display Area

The M Series default unit of measure is degrees Fahrenheit (°F), but you can configure the M Series to display degrees Celsius (°C). See the *M Series Configuration Guide* for instructions on how to configure alternate units of measure.

Setting Alarms

Before taking a measurement, check that all the temperature alarm settings are appropriate for the situation. You can set the alarms for Temperature Channel 1 (T1), Temperature Channel 2 (T2), and Δ T separately. See *M Series Operator's Guide* for instructions on setting alarms.

The M Series Temperature option includes temperature alarms for the following measurements:

Table 1: Alarm Limit Settings and Defaults

Alarm Limit:	Default Setting:	Range (increments of 0.1):
Temperature (T1 and T2)	High 100° F; 37.8° C Low 95° F; 35.0° C	High 59.2 to 113.0° F; 15.1 to 45.0° C Low 59.0 to 112.8° F; 15.0 to 44.9° C
Difference between T1 and T2 (Δ T)	High 5.0° F; 2.8° C Low 0.0° F; 0.0° C	High 0.2 to 54.0° F; 0.1 to 30.0° C Low 0.0 to 53.8° F; 0.0 to 29.9° C

When the M Series is turned on, all alarm functions are disabled and the alarm limits are set to their default values. Any changes to these settings remain in effect until either the settings are changed or 10 seconds after the M Series is turned off.

Setting Alarm Limits

You can change all the alarm limits using the standard M Series procedures. See *M Series Operator's Guide* for instructions on setting alarm limits.

You can set the alarm limits using the Auto function, or you can choose your own limits (see above table). The Auto function sets the high limit to 0.5° F (0.3° C) above and the low limit to 0.5° F (0.3° C) below the measured temperature when limits are set.

Enabling, Disabling and Suspending Alarms

You can enable, disable and suspend all Temperature alarms using the standard M Series procedures. See *M Series Operator's Guide* for instructions on enabling, disabling, and suspending alarms.

Setting alarms for one temperature channel has no affect on the alarms for the other temperature channel. Enabling, disabling or suspending Temperature alarms does not affect the status of other M Series alarms.

Printing Temperature Data

See the *M Series Operator's Guide* Recorder Operation section for instructions on how to record data. If you are currently displaying temperature, press the RECORDER button to print a strip chart that includes the following values:

- T1
- T2
- ΔT
- Time of measurement.

Maintaining the Temperature Option

See the *M Series Service Manual* for instructions on maintaining the Temperature option.

Performing the Daily Checkout Procedure

The following is a checkout procedure that should be performed daily to ensure that the Temperature option is functioning properly. In addition, this daily checkout procedure ensures that medical personnel maintain familiarity with the proper use of the Temperature option. For more specific instructions on how to accomplish each step listed below, refer to the related section in this manual.

Use only YSI 400-compatible temperature simulators. See "Ordering Accessories" on page 8 for a list of ZOLL-approved temperature simulators. Daily checkout for the T2 channel also requires a ZOLL 2-channel Y-adapter.

To perform the daily checkout procedure:

1. Connect the temperature simulator cable to the M Series unit and the temperature simulator.
2. Set the simulator to simulate 68° F or 20° C.
3. Verify that the M Series displays 68° F (+/- 0.2° F) or 20° C (+/- 0.2° C).
4. Set the simulator to simulate 104° F or 40° C.
5. Verify that the M Series displays 104° F (+/- 0.2° F) or 40° C (+/- 0.2° C).

Repeat steps 1 - 5 using the other temperature channel.

Specifications

Table 2: General Specifications

Principle of Operation	Thermistor - YSI 400 compatible only

Table 3: Temperature Measurement Specifications

Temperature Measurement Range	59° to 113° F (15° to 45° C)
Accuracy	+/- 0.09° F (0.05° C) (not including sensor)
Sampling Rate	1 sample/sec (1 Hz)
Resolution	0.1° F (0.06° C)

Table 4: Battery Operating Time Specifications (using ZOLL XL Battery Pack)

For a new, fully charged battery pack at 20°C with IBP, $EtCO_2$, SpO_2, NIBP and Temperature options	60 defibrillator discharges at maximum energy (200J Biphasic), or 1.75 hours minimum of continuous ECG, IBP (2 channels), $EtCO_2$, SpO_2, and Temperature monitoring, or 2.00 hours of continuous ECG monitoring/pacing at 60 mA, 70 beats/min.

Table 5: Environmental Specifications

Operating Temperature	32° to 122° F (0° to 50° C)
Storage and Shipping Temperature	-4° to 140° F (-20° to 60° C)
Electromagnetic Immunity	AAMI DF-2: 1996, EN 61000-4-3: 1996, 15 V/m
Humidity	5 to 95% relative humidity, non-condensing
Operating Pressure	594 to 1060 mBar

Table 6: Alarm Limits Specifications

Temperature	High 59.2 to 113.0° F Low 59.0 to 112.8° F	High 15.1 to 45.0° C; Low 15.0 to 44.9° C
ΔTemp (difference in temperature)	High 0.2 to 54.0° F Low 0.0 to 53.8° F	High 0.1 to 30.0° C; Low 0.0 to 29.9° C

Software License

Read this License agreement carefully before operating any of the M Series products.

Software incorporated into the system is protected by copyright laws and international copyright treaties as well as other intellectual property laws and treaties. This software is licensed, not sold. By taking delivery of and using this system, the Purchaser signifies agreement to and acceptance of the following terms and conditions:

Grant of License: In consideration of payment of the software license fee which is part of the price paid for this product ZOLL Medical Corporation grants the Purchaser a non-exclusive license, without right to sublicense, to use the system software in object-code form only.

Ownership of Software/Firmware: Title to, ownership of and all rights and interests in the system software and all copies thereof remain at all times vested in the manufacturer, and Licensors to ZOLL Medical Corporation and they do not pass to Purchaser.

Assignment: Purchaser agrees not to assign, sub-license or otherwise transfer or share its rights under the license without the express written permission of ZOLL Medical Corporation.

Use Restrictions: As the Purchaser, you may physically transfer the products from one location to another provided that the software/firmware is not copied. You may not disclose, publish, translate, release or distribute copies of the software/firmware to others. You may not modify, adapt, translate, reverse engineer, decompile, crosscompile, disassemble or create derivative works based on the software/firmware.

No Implied License

Possession or purchase of this device does not convey any express or implied license to use the device with replacement parts which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

Ordering Accessories

To order accessories for the M Series Temperature option call ZOLL Customer Service at 1-800-348-9011. Customers outside the United States should call the nearest authorized ZOLL Medical Corporation sales representative. The following tables list optional accessories that can be used with the M Series Temperature option:

Table 7: ZOLL-Approved Temperature Probes

Item:	ZOLL Part Number:	Manufacturer Contact Information:
YSI 401 Reusable Esophageal/Rectal - Adult	8000-0668	Yellow Springs Instruments 2670 Indian Ripple Road Dayton, OH 45440-3605 (937) 427-1231
YSI 402 Reusable Esophageal/Rectal - Pediatric	8000-0669	
YSI 409B Reusable Skin - Adult	8000-0670	
YSI 427 Reusable Skin - Pediatric	8000-0671	
YSI 4491E Single Use Esophageal/Rectal	8000-0672	
YSI 4499E Single Use Skin	8000-0673	

Table 8: Interface Cables

Item:	ZOLL Part Number:	Manufacturer Contact Information:
YSI 4940 Interface Cable for Single Use probes	8000-0674	Yellow Springs Instruments 2670 Indian Ripple Road Dayton, OH 45440-3605 (937) 427-1231
2-channel Y-adapter	8000-0675	ZOLL Customer Service (800) 348-9011

Table 9: Temperature Simulators

Item:	ZOLL Part Number:	Manufacturer Contact Information:
Fogg TP400 Simulator w cable	8000-0676	Fogg System Company, Inc. 15592 East Batavia Drive Aurora, CO 80011 (303) 344-1883

Troubleshooting

The following table lists the Temperature messages, the problem each message indicates, and the actions you should take to fix the problem. Read this section carefully before monitoring patients. For further assistance, call ZOLL Technical Service at 1-800-348-9011. Customers outside the United States should call the nearest authorized ZOLL Medical Corporation sales representative.

Message/Symptom:	Problem:	User Action:
CHECK TEMPERATURE PROBE	The temperature probe connection is broken or an open circuit is detected.	Check temperature probe and cabling for loose connection. Replace the temperature probe or cabling.

(This page intentionally left blank.)

Index

Numerics

2-channel Y-adapter
- approved type 8
- ordering 8
- when necessary 5

A

Accessories, ordering 8
Accuracy
- specification 6
- suspect readings v

Adapter
- See 2-channel Y-adapter

Alarm
- auto setting 4
- defaults 4
- disabling 4
- enabling 4
- limits 4
- range 4
- setting 4
- suspended v
- suspending 4

Alarm limit
- defaults 4
- range 4
- setting 4

Alarm status, reading on display 4
Anesthetics, use with Temperature option v
Auto alarm setting, description of 4

B

Battery operating time 6

C

Cable
- See Interface cable

Cable routing, warning v
Caution
- connecting ECG-out jack vi
- disposable sensors vi
- general v
- immersion v
- interpretation of readings v
- modem connection vi
- qualified personnel only v
- sterilization v
- suspect readings v
- suspended alarm v

Channels, temperature 2
CHECK TEMPERATURE PROBE message
- significance of 9

Checkout procedure 5
Connecting temperature probe 2
Connector, location of 3
Contraindications vi

D

Daily checkout procedure 5
Default
- alarm 4
- unit of measurement 4

Defibrillation
- defib-proof parts vi
- warning v

Delta symbol, description of 3
Display, reading 3
Disposable sensor, caution against reusing vi

E

ECG-out jack, connecting caution vi
Electromagnetic immunity 6
Explosion, warning v

F

Features of Temperature option listed 1

H

Humidity specification 6

I

Immunity, electromagnetic 6
Indications for use vi
Interface cable
- approved types 8
- connecting 2
- ordering 8

Interpretation of readings by physician only v

L

License, software 7

M

M Series
- cleaning caution v
- turning on 2

Measurement specifications
- See Temperature measurement

Modem, connection caution vi
Monitor, turning on 2

N

Neonatal patients, contraindications vi

O

On, turning on monitor 2
Operating conditions
- electromagnetic immunity 6
- humidity 6
- temperature 6

Ordering accessories 8

P

Pediatric patients, indications vi
Personnel, qualified for operation v
Phone number
- customer service 8
- technical service 9

Principle of operation 6
Printing
- temperature data 5
- types of measurements printed 5

Probe
- See temperature probe

R

Range specification 6
Recording, temperature data 5
Resolution specification 6

S

Safety information v
Sampling rate specification 6
Sensor, caution against reusing disposables vi
Setting alarm 4
Shipping temperature 6
Software license 7
Specifications 6
Sterilization, caution v
Storage temperature 6
Suspended alarm v

T

T1, description of 3
T2, description of 3
Temperature
- operating 6
- shipping 6
- storing 6

Temperature connector, location of 3
Temperature data display area
- data included in 3
- description of 3
- location of 3

Temperature measurement
- accuracy 6
- principle of operation 6
- range 6
- resolution 6
- sampling rate 6

Temperature option
- contraindications vi
- factors affecting accuracy 3
- features of 1
- how it works 1
- indications for use vi
- overview of use 1
- printing 5
- recording 5
- when temp values display 3

Temperature probe
- approved types 8
- caution against use of YSI 700 2
- connecting 2
- ordering 2, 8
- selecting proper type 2
- using two simultaneously 2
- Y-adapter 2
- YSI 400 compatible 2

Temperature simulator
- approved type 8
- ordering 8

Temperature value, reading on display 4
Troubleshooting 9

U

Unit of measurement, reading on display 4

W

Warning
- anesthetics v
- cable routing v
- defibrillation v
- explosion v
- general v
- oxygen-rich atmosphere v

Water, caution against immersion v

Y

Y-adapter
- See 2-channel Y-adapter

Z

ZOLL
- customer service phone number 8
- technical service phone number 9